Executive Summary

The City of San Diego (City) conducts extensive ocean monitoring to evaluate potential environmental effects from the discharge of treated wastewater to the Pacific Ocean via the Point Ocean Outfall (PLOO). The data collected are used to determine compliance with receiving water conditions as specified in the National Pollution Discharge Elimination System (NPDES) permit for the City's Point Loma Wastewater Treatment Plant (PLWTP).

The primary objectives of the Point Loma ocean monitoring program are to: (a) measure compliance with NPDES permit requirements and California Ocean Plan (Ocean Plan) standards, (b) monitor changes in ocean conditions over space and time, and (c) assess any impacts of wastewater discharge or other man-made or natural influences on the local marine environment, including effects on water quality, sediment conditions and marine life. The study area encompasses approximately 184 km^2 of coastal waters centered around the PLOO discharge site, which is located approximately 7.2 km offshore of the PLWTP at a depth of nearly 100 m. Shoreline monitoring extends from Mission Beach southward to the tip of Point Loma, while regular offshore monitoring occurs in an adjacent area at sites ranging from about 9 to 116 m in depth.

The City conducts other types of studies in addition to its regular monitoring for Point Loma that are useful for evaluating patterns and trends over time or that span broader geographic regions, thus providing additional information to help distinguish reference areas from sites that may be affected by anthropogenic influences. For example, prior to the initiation of wastewater discharge at the present deepwater location in late 1993, the City conducted a 2½-year baseline study designed to characterize background environmental conditions in the Point Loma region. Additionally, a broader geographic survey of benthic conditions is typically conducted during the summer each year at sites ranging from northern San Diego County (around La Jolla–Del Mar) south to the USA/Mexico international border as part of the monitoring program for the South Bay Ocean Outfall. Results of the 2010 regional survey are included in the annual receiving waters monitoring report for the South Bay outfall region. The City also collaborates with other organizations on larger-scale, regional monitoring projects that span the entire Southern California Bight (SCB). These bight-wide surveys include the original pilot project in 1994, and subsequent Bight'98, Bight'03, and Bight'08 projects (see Chapter 1).

The receiving waters monitoring activities for the Point Loma region are separated into several major components, which are organized into seven chapters in this report. Chapter 1 presents a general introduction and overview of the Point Loma ocean monitoring program, as well as background information on wastewater treatment processes at the PLWTP, including the initiation of chlorination in late 2008. In Chapter 2, data regarding various physical and chemical parameters are evaluated to characterize oceanographic conditions and water mass transport potential for the region. Chapter 3 presents the results of water quality monitoring conducted along the shore and in local coastal waters, including measurements of fecal indicator bacteria (FIB) to determine compliance with Ocean Plan water-contact standards. Assessments of benthic sediment quality and the status of soft-bottom macrobenthic invertebrate communities are presented in Chapters 4 and 5, respectively. Chapter 6 presents the results of trawling activities designed to monitor communities of demersal (bottom dwelling) fishes and megabenthic invertebrates. Bioaccumulation assessments to determine if contaminants are present in the tissues of local fishes captured via trawls or by hook and line are presented in Chapter 7. In addition to the above activities, the City supports other projects relevant to assessing the quality of ocean waters in the region. One such project involves aerial

and satellite imaging studies of the San Diego/ Tijuana coastal regions. The results of these remote sensing efforts conducted in 2010 are incorporated herein into discussions and interpretations of oceanographic and water quality conditions (see Chapters 2 and 3).

This report focuses on the results and conclusions of all ocean monitoring activities conducted in the Point Loma region from January 1, 2010 through December 31, 2010. An overview and summary of the main findings for each of the major components of the program are included below.

Oceanographic Conditions

The Point Loma outfall region was characterized by typical oceanographic conditions in 2010. This included seasonal patterns such as coastal upwelling with corresponding phytoplankton blooms in the spring and summer, maximum stratification (layering) of the water column in mid-summer, and reduced stratification during the winter and fall. Remote sensing observations revealed no visible evidence of the wastewater plume reaching surface waters, even during the winter and fall months when the water column was only weakly stratified. This is consistent with results from the bacteriological surveys conducted during the year (see below). There was also no evidence that the wastewater plume reached nearshore recreational waters or the shoreline during the year. For example, analysis of current meter data indicated that current conditions in 2010 were not conducive to shoreward transport of the plume. Instead, these results showed currents moving predominantly offshore throughout the year in mostly north/northwest or south/southeast directions. Overall, the observed variations in ocean conditions off Point Loma this past year were consistent with expectations due to typical seasonal cycles, as well as with changes in larger patterns reported for the California Current System. Together, this suggests that other factors such as the upwelling of cool, nutrient-rich deep ocean waters, the occurrence of associated plankton blooms, and the effects of large-scale oceanographic events may best explain most of the temporal and spatial variability observed in the region.

Water Quality

There was no evidence that wastewater discharged to the ocean via the PLOO reached surface or near-shore recreational waters in 2010. For example, the wastewater plume was not detected in any aerial and satellite imagery taken during the year. Although elevated counts for fecal indicator bacteria (FIB) such as total coliforms, fecal coliforms and enterococcus were occasionally detected along the shore and at a few nearshore stations, concentrations of these bacteria tended to be relatively low overall. Over the years, elevated FIBs detected at the shore and kelp bed stations have tended to be associated with rainfall events, heavy recreational use, or the presence of seabirds or decaying kelp and surfgrass. During 2010, most high counts were limited to instances when contamination was most likely the result of heavy rainfall that increased outflows and the dispersion of associated turbidity plumes from the San Diego River, San Diego Bay, and even the Tijuana River. The elevated FIB counts that could likely be attributable to wastewater discharge were limited to offshore waters at depths of 60 m or below. This finding supports previous water quality analyses for the region, which have indicated that the PLOO wastefield typically remains offshore and submerged in deep waters.

Bacterial compliance levels were summarized as the number of days that each of the shore, kelp bed and offshore stations within State waters exceeded various Ocean Plan water-contact standards during each month. Due to regulatory changes that became effective August 1, 2010, compliance was assessed using the standards specified in the 2001 Ocean Plan for samples collected from January 1 through July 31, 2010, whereas samples collected after August 1, 2010 were assessed using 2005 Ocean Plan standards. Compliance with these standards was very high throughout the year with an overall compliance rate of 99.7% over all stations.

Additionally, ammonia (sampled as nitrogen) was detected infrequently and at only very low levels, throughout the kelp bed and offshore areas, and there was no correspondence between ammonia concentrations and FIB levels.

Sediment Conditions

Ocean sediments at stations surrounding the PLOO in 2010 were composed primarily of fine sands and coarse silt, which is similar to patterns seen in previous years. Differences in the particle size composition of Point Loma sediments are likely affected by both anthropogenic and natural influences, including outfall construction materials, offshore disposal of dredged materials, multiple geological origins of different sediment types, and recent deposits of detrital materials. There was no evident relationship between sediment composition and proximity to the outfall discharge site.

Overall, sediment quality at the PLOO monitoring sites was similar in 2010 to previous years, and there were few clear patterns in contaminant accumulation relative to the discharge site. The only exceptions were slightly elevated sulfide and biochemical oxygen demand (BOD) levels at a few stations located within about 300 m of the outfall. Sediment concentrations of the various trace metals, organic loading indicators, pesticides (e.g., DDT), PCBs and PAHs remained within the typical range of variability for San Diego and other coastal areas of southern California. The potential for degradation by any of the detected chemical contaminants was further evaluated by using the Effects Range Low (ERL) and Effects Range Median (ERM) sediment quality guidelines as benchmarks. Only two samples contained levels of DDT that exceeded available ERLs, and none of the contaminants detected in 2010 exceeded their ERM. Additionally, the highest concentrations of several contaminants occurred at sites relatively distant from the outfall. For example, concentrations of several organic indicators and trace metals were highest in sediments from the northern-most stations. In contrast, several pesticides, PCBs, and PAHs were detected mostly in sediments from stations located south of the outfall. This latter pattern is consistent with other studies that have suggested that sediment contamination at these and other southern stations off San Diego is most likely due to misplaced deposits (short dumps) of dredged materials originally destined for the LA-5 disposal site located southwest of the PLOO discharge site.

Macrobenthic Communities

Benthic macrofaunal communities in the PLOO region in 2010 were dominated by polychaete worm and ophiuroid (brittle star) assemblages in terms of abundance, with few major changes in population numbers of these animals having occurred since monitoring began in 1991. Additionally, polychaetes were extremely diverse across the region. Although invertebrate assemblages at each survey site contained a similar mix of species, the relative abundance of these species varied among sites, likely because of sediment heterogeneity. The brittle star *Amphiodia urtica* was the most abundant species across the region, while the bivalve *Axinopsida serricata* was the second most abundant benthic invertebrate. Overall, the invertebrate assemblages documented were typical of those occurring in other mid-depth areas of the SCB where similar, relatively fine sediment habitats occur.

Benthic invertebrate assemblages off Point Loma have changed in a relatively small, localized region within ~300 m of the outfall diffuser legs as would be expected near large ocean outfalls. For example, some descriptors of benthic community structure (e.g., infaunal abundance, species diversity) or populations of indicator species (e.g., *A. urtica*) have indicated shifts in species composition or abundance over time between reference areas and sites located nearest the outfall. However, despite these changes, results for the benthic response index (BRI) remain characteristic of undisturbed sediments. In addition, documented changes in macrofaunal community structure near the outfall in 2010 were similar in magnitude to those reported previously for the PLOO and elsewhere off southern

California. Overall, macrofaunal assemblages in the region remain similar to those observed prior to wastewater discharge and to natural indigenous communities characteristic of similar habitats on the southern California continental shelf. There was no evidence that wastewater discharge has caused degradation of the marine benthos in the PLOO monitoring region.

Demersal Fishes and Megabenthic Invertebrates

Pacific sanddabs continued to dominate fish assemblages surrounding the PLOO during 2010 as they have for many years. This species occurred at all stations and accounted for 42% of the total fish catch. Other characteristic, but less abundant fishes included California lizardfish, halfbanded rockfish, longspine combfish, plainfin midshipman, pink seaperch, yellowchin sculpin, Dover sole, stripetail rockfish, shortspine combfish, English sole, greenstriped rockfish, and bigmouth sole. Although the overall composition and structure of the local fish assemblages varied among stations, most differences were due to fluctuations in Pacific sanddab populations.

Assemblages of relatively large (megabenthic) trawl-caught invertebrates in the region were similarly dominated by a single species, the white sea urchin *Lytechinus pictus*. Consequently, variations in megabenthic community structure off Point Loma generally reflect changes in the abundance of this urchin, although other species such as the brittle star *Ophiura luetkenii*, the sea pen *Acanthoptilum* sp*,* the sea slug *Pleurobranchaea californica*, the sea cucumber *Parastichopus californicus,* the sea stars *Astropecten verrilli* and *Luidia foliolata*, and the octopus *Octopus rubescens* also contributed to community differences.

Overall, the 2010 trawl survey results indicate that trawl-caught fish and invertebrate communities in the region are unaffected by wastewater discharge. Although highly variable, patterns in the abundance and distribution of these organisms were similar at stations located near the outfall and farther away, suggesting a lack of significant anthropogenic influence. Instead, changes in these communities appear to be more likely due to natural factors such as seasonal water temperature fluctuations or large-scale oceanographic events (e.g., El Niño), as well as to the mobile nature of many species.

The types and frequencies of external health problems for fish can be important indicators of environmental impact. Examinations of trawl-caught fishes for evidence of disease (e.g., tumors, fin erosion, skin lesions) or the presence of ectoparasites showed that local fish populations remain healthy. For example, external parasites and other external abnormalities occurred in less than 1% of the fishes collected in the Point Loma region during 2010. Overall, these results were consistent with findings from previous years and provided no indication of outfall effects.

Contaminants in Fish Tissues

There was no clear evidence to suggest that tissue contaminant loads in fishes captured at the PLOO monitoring sites were affected by the discharge of wastewater in 2010. Although several metals, three pesticides, and various PCB congeners were detected in liver tissues from flatfish and muscle tissues from rockfish sampled in the region, these contaminants were found in fishes distributed widely among stations and showed no patterns that could be attributed to wastewater discharge. Further, all contaminant values were within the range of those reported previously for southern California fishes. Finally, while some muscle tissue samples from sport fishes collected off Point Loma had arsenic and selenium concentrations above the median international standard for shellfish, and some samples had mercury and PCB levels that exceeded OEHHA fish contaminant goals, concentrations of mercury and DDT were still below USFDA human consumption limits.

The occurrence of both trace metals and chlorinated hydrocarbons in the tissues of Point Loma fishes may be due to many factors, including the widespread distribution of many contaminants

in coastal sediments off southern California. Other factors that affect the bioaccumulation and distribution of contaminants in local fishes include the different physiologies and life history traits of various species. Exposure to contaminants can vary greatly between species and even among individuals of the same species depending on migration habits. For example, fishes may be exposed to pollutants in a highly contaminated area and then move into a region that is less contaminated. This is of particular concern for fishes collected in the vicinity of the PLOO, as there are many other point and non-point sources in the region that may contribute to contamination.

Conclusions

The findings and conclusions for the 2010 ocean monitoring effort for the Point Loma outfall region were consistent with previous years. Overall, there were limited impacts to local receiving waters, benthic sediments, and marine invertebrate and fish communities. There was no evidence that the PLOO wastefield reached surface waters or nearshore recreational areas during the year. Although elevated bacterial levels did occur along the shore and at various kelp bed sites, such instances were largely associated with higher rainfall during the wet season and not to shoreward transport of the wastewater plume. There were also no outfall related patterns in sediment contaminant distributions, or in differences between the various invertebrate and fish assemblages. The general lack of disease symptoms in local fish populations, as well as the low level of contaminants detected in fish tissues, was also indicative of a healthy marine environment. Finally, benthic habitats in the region remain in good condition similar to much of the Southern California Bight mainland shelf.

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